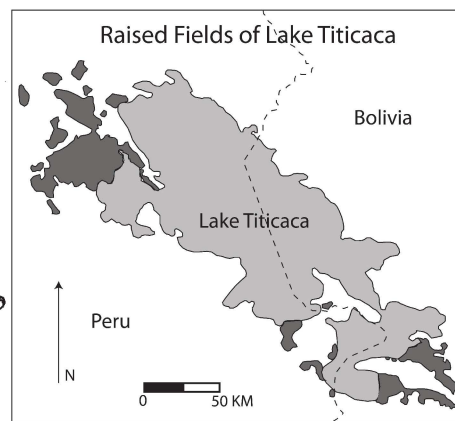


Chapter 22

Raised Fields as Monumental Farmed Landscapes, Lake Titicaca, South America

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CIRCUMSTANCES UNDER WHICH THE GARDEN WAS INVESTIGATED

In the 1960s and 1970s, vast landscapes of abandoned pre-Columbian raised fields were documented in Peru, Bolivia, Ecuador, Colombia, Suriname, and Guyana. This form of intensive agriculture is associated with large and dense sedentary populations and in some cases sustained complex sociopolitical organizations. Raised fields are large elevated planting platforms designed to provide drainage and improve soil conditions and fertility. Deep water-filled canals alongside the platforms provide moisture during dry periods, protect crops against frost, and produce organic matter for sustained harvests.

A multiyear, multidisciplinary research project began in 1981, to understand the raised fields located high in the Andes Mountains (3,800 meters asl.) in the Lake Titicaca basin of Peru and Bolivia. Raised fields are locally known as *waru waru* (Quechua) and *suka kollus* (Aymara). The primary goals of the investigation were to date the origins, use periods, and abandonment; determine the field functions, crop yields, carrying capacity, labor, and social organization necessary to build and maintain fields; and evaluate the potential contribution of raised fields as a model of sustainable development and appropriate technology.

SITE DESCRIPTION

Location

The raised fields are located in the Altiplano (high altitude plain) of the Lake Titicaca basin between the eastern and western cordilleras at 3,800 meters asl. Although classified by agronomists and development planners as marginal for agriculture, hundreds of generations of pre-Columbian farmers of the Lake Titicaca basin completely transformed the environment into an anthropogenic or cultural landscape through construction of raised fields, stone walled terraces, and sunken gardens. Raised fields, found in areas with a high water table, seasonal flooding, and permanent wetlands around the lake edge cover 122,000 hectares.

Basic history

Dating of the origins, use period, and abandonment of gardens and fields can be difficult. The raised fields of the Lake Titicaca basin were dated using a combination of direct techniques (stylistic and thermoluminescence dating of pottery and AMS and regular radiocarbon dating of organics recovered in situ within field stratigraphy) and indirect techniques (association of field systems to settlements). The earliest raised fields, dating to 1000-800 BCE (3000-2800 BP), are associated with the Chiripa and Qaluyu cultures. Farmers of the Pukara (200 BCE-300 CE) and Tiwanaku cultures (600-1000 CE) expanded raised field agriculture. Raised fields were farmed until either the Inca or Spanish conquests of the Lake Titicaca basin (between 1450 and 1530 CE). Scholars are divided on the cause of abandonment of raised field agriculture. Kolata and colleagues argue that drought conditions after 1000 CE made raised field farming unfeasible. Others have evidence that farmers continued to use raised fields until the Inca conquest of the region after 1450. The massive demographic collapse of native populations caused by epidemics, labor exploitation, and civil wars during the early colonial period sealed the fate of raised field agriculture.

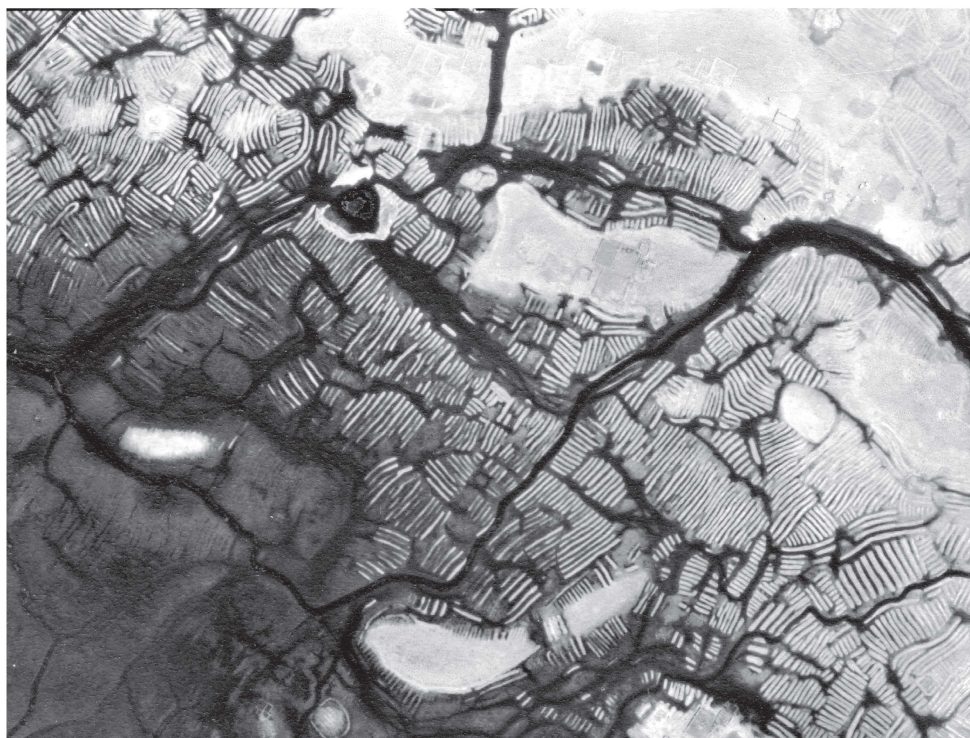
Excavation history

Archaeologist Max Uhle first reported the raised fields in the late 19th century. Geographer William Denevan and colleagues did the first descriptive study of the raised fields in the 1960s. Since then, raised fields have been studied in detail by archaeologists Tom Lennon, Alan Kolata, Gray Graffam, Matt Seddon, Matt Bandy and Clark Erickson during the 1980s and 1990s. As a result, the raised fields of the Lake Titicaca basin are now the best studied pre-Columbian agrarian landscape in the Americas.

METHODS

Our project team used a number of standard and non-standard archaeological techniques to investigate raised fields. Analysis of aerial photographs was essential for determining the extent of and mapping the diverse patterns of raised fields (fig. 1).

Blocks of raised fields were mapped on the ground using theodolite, compass, and tape measure. We dug excavation trenches measuring 5-10 meters long, 1 meter wide, and 1-2 meters deep perpendicular to the long axis of canals and field platforms to expose internal field and canal stratigraphy, recover crop remains, collect soil samples, and obtain samples of pottery for stylistic and thermoluminescence dating (fig. 2).



1. Aerial photograph of the complex formal patterning of pre-Columbian raised fields at the edge of Lake Titicaca, Peru. Old canals (dark lines) between the raised field platforms (light lines) are clearly visible.



2. Excavation of pre-Columbian raised fields in Huatta, Peru.

The most innovative method used in this study was experimental archaeology. Because raised fields were abandoned some 500 years ago, contemporary farmers are unfamiliar with raised field farming; thus archaeology provides the only means of understanding the technology and knowledge of this impressive process. Researchers collaborating with Peruvian agronomists, the Ministry of Agriculture, and local nongovernment organizations conducted raised field experiments (fig. 3). Working with native communities of Quechua farmers in Huatta and Coata between 1981 and 1986, they rebuilt many hectares of raised fields using the results of archaeological excavations and mapping. Records were kept of person-days of labor needed to rebuild the fields. Raised fields were planted in a variety of indigenous crops. Field and crop conditions, in particular water tables, soils, and episodes of frost, flooding, and drought, were monitored throughout several growing seasons. Data on crop production was collected for all fields.



3. Rehabilitated pre-Columbian raised fields on the lake plain near Huatta, Peru. The earth platforms (5m wide and 50cm tall) are planted in potatoes (1986).

RESULTS

Aerial and topographic mapping provided valuable information about variations of field size and patterns. Some variation of patterns was determined to be clearly associated with local environmental conditions while others may have been chronological or stylistic variations. Excavations and stratigraphic dating demonstrated that individual fields had complex histories of construction, multiple use, renovation, rebuilding, and abandonment. Farmers replaced earlier small fields of

narrow wavelength (a measurement of canal center to adjacent canal center) with larger fields of a longer wavelength over time. Excavations and experimental reconstruction of raised fields provided valuable information about the functions of the fields. Experiments involving the construction and cultivation of raised fields gave us data regarding the social organization and labor necessary to build and maintain the fields, crop production, population carrying capacity, sustainability, and environmental impact. Many archaeologists assume that raised field agriculture is labor intensive and difficult to design and manage and thus is likely to be the product of state initiatives. Researchers found that families, groups of families, and small communities could build and maintain the fields. The average size of individual blocks or bundles of pre-Columbian fields was identical to what an individual family of five could build during the off-season between harvest and planting and sustain them for a year. A single hectare of raised field platforms planted with potatoes could support 30 people for a year. The research showed that raised fields represent a remarkable form of permanent landscape capital that grew through the labor of many generations of farmers who passed down their accumulated improvements to the land. The investigation shows that raised field agriculture was sustained over 2,500 years, supported large and dense populations, and provided the productive base for the civilizations that developed in the region.

During the 1980s and 1990s, various government and nongovernmental organizations in Peru and Bolivia promoted raised field agriculture in their development programs directed toward Andean communities. Although many of these projects failed or were neglected during the period of civil unrest and economic crisis of the late 1980s and early 1990s, some farmers continue to cultivate raised fields that were reconstructed during this period.

CONCLUSION

Raised fields are part of a vast anthropogenic, engineered landscape, as monumental as any of the better-known archaeological sites in the Andes. Beyond simply being a means of producing foods, the elaborate field patterns suggest that farmers intentionally planned and designed these field systems to create a structured, orderly, and aesthetically pleasing cultural landscape. This abandoned agrarian landscape is also important as cultural heritage, highlighting the technological achievements, knowledge, and skills of Andean farmers. The Quechua and Aymara and the modern nation states of Peru and Bolivia now proudly claim this pre-Columbian legacy as significant cultural heritage.

Bibliography

- 1988 "Raised field agriculture in the Lake Titicaca basin: putting ancient Andean agriculture back to work," *Expedition*, 30/3, p. 8-16, special volume edited by Karen MOHR CHAVEZ on *Andean Archaeology*, Philadelphia, The University Museum, University of Pennsylvania.
- 1993 "The social organization of prehispanic raised field agriculture in the Lake Titicaca basin," in Vernon SCARBOROUGH & Barry ISAAC (eds), *Economic Aspects of Water Management in the Prehispanic New World*, JAI Press, p. 369-426 (*Research in Economic Anthropology*, Supplement 7).
- 1994 "Methodological considerations in the study of ancient Andean field systems," in Kathryn GLEASON & Naomi MILLER (eds), *The Archaeology of Garden and Field*, Philadelphia, University of Pennsylvania Press.
- 1998 "Applied archaeology and rural development: archaeology's potential contribution to the future," in Michael WHITEFORD & Scott WHITEFORD (eds), *Crossing Currents: Continuity and Change in Latin America*, Upper Saddle River, New Jersey, Prentice-Hall, p. 34-45.
- 2000 "The Lake Titicaca basin: a pre-Columbian built landscape," in David LENTZ (ed.), *Imperfect Balance: Landscape Transformations in the Precolumbian Americas*, New York, Columbia University Press, p. 311-356.
- In press "Agricultural landscapes as world heritage: raised field agriculture in Bolivia and Peru," in Jeanne-Marie TEUTONICO & Frank MATERO (eds), *Managing Change: Sustainable Approaches to the Conservation of the Built Environment*, 4th US/ICOMOS International Symposium Proceedings, Getty Conservation Institute in collaboration with US/ICOMOS and the University of Pennsylvania Graduate School of Fine Arts.